

What is claimed is:

- 1) A liquid dispensing device, comprising:
  - A. a tray for holding a liquid at a relatively constant level defining an approximately constant tray liquid level,
  - B. a liquid container containing a liquid having an opening and positioned upside-down in said tray with the opening defining a vertical position approximately equal to or below the relatively constant tray liquid level such that atmospheric pressure on the liquid in said tray and vacuum inside said container prevents liquid from draining from said container except when the liquid level in said tray drops to a level approximately equal to or below the vertical position of said opening, and
  - C. a syringe for drawing liquid from said tray,wherein positioning of said syringe for drawing fluid is simplified by reason of the fact that the level of fluid in said tray is maintained at an approximately constant level despite withdrawal of quantities of fluid from said tray.
- 2) The liquid dispensing device as in Claim 1, further comprising a retaining clip for attaching said upside-down container to said liquid dispensing device.
- 3) The liquid dispensing device as in Claim 1, further comprising an air filter for filtering air entering said liquid dispensing device.
- 4) The liquid dispensing device as in Claim 1, further comprising a tilted bottom component for puddling liquid below said syringe.
- 5) The liquid dispensing device as in Claim 1, further comprising a liquid level indicator.
- 6) The liquid dispensing device as in Claim 1, wherein said syringe is manually removably inserted into said liquid dispensing device by the hand of an operator.

- 7) The liquid dispensing device as in Claim 1, wherein said syringe is automatically removably inserted into said liquid dispensing device by the utilization of an automated liquid mixing device, and wherein liquid is automatically transferred to a liquid receiving device.
- 8) The liquid dispensing device as in Claim 7, wherein said liquid receiving device is a micro-well plate.
- 9) The liquid dispensing device as in Claim 7, wherein said liquid dispensing device is at least one liquid dispensing device, wherein said automated liquid handling device comprises:
  - A. a robotic syringe grabber positionable above said at least one liquid dispensing device,
  - B. at least one horizontal positioning linear actuator for horizontally positioning said robotic syringe grabber above said at least one liquid dispensing device, and
  - C. a computer programmed to control said at least one horizontal positioning linear actuator and said robotic syringe grabber.
- 10) The liquid dispensing device as in Claim 9, wherein said syringe comprises a plunger, wherein said robotic syringe grabber comprises:
  - A. a linear actuator for vertically positioning said robotic syringe grabber at the height of said syringe and for lifting said syringe clear of said at least one dispensing device, and for positioning said robotic syringe grabber at the height of said liquid receiving device
  - B. a syringe gripper for gripping said syringe,
  - C. a plunger gripper for gripping said plunger, and
  - D. a second linear actuator for raising said plunger to draw liquid into said syringe and for lowering said plunger to dispense liquid into said liquid receiving device.

- 11) The liquid dispensing device as in Claim 10, wherein said robotic syringe grabber further comprises an actuator for transmitting shock waves to said syringe, wherein said shock waves are utilized to dislodge drops of liquid adhering to said syringe.
- 12) The liquid dispensing device as in Claim 7, wherein said liquid dispensing device is a plurality of liquid dispensing devices arranged on a platform, wherein each of said plurality of liquid dispensing devices comprises at least one locating indentation, wherein said platform comprises at least one locating pin, wherein said at least one indentation is aligned with said at least one locating pin.
- 13) A liquid dispensing device, comprising:
- A. a tray means for holding a liquid at a relatively constant level defining an approximately constant tray liquid level,
  - B. a liquid container means containing a liquid having an opening and positioned upside-down in said tray with the opening defining a vertical position approximately equal to or below the relatively constant tray fluid level such that atmospheric pressure on the liquid in said tray means and vacuum inside said container means prevents liquid from draining from said container means except when the fluid level in said tray means drops to a level approximately equal to or below the vertical position of said opening, and
  - C. a syringe means for drawing fluid from said tray means, wherein positioning of said syringe means for drawing fluid is simplified by reason of the fact that the level of fluid in said tray means is maintained at an approximately constant level despite withdrawal of quantities of fluid from said tray means.
- 14) The liquid dispensing device as in Claim 13, further comprising a retaining clip means for attaching said container means to said liquid dispensing device.

- 15) The liquid dispensing device as in Claim 13, further comprising an air filter means for filtering air entering said liquid dispensing device.
- 16) The liquid dispensing device as in Claim 13, further comprising a tilted bottom means for puddling liquid below said syringe means.
- 17) The liquid dispensing device as in Claim 13, further comprising a liquid level indicator means.
- 18) The liquid dispensing device as in Claim 13, wherein said syringe means is manually removably inserted into said liquid dispensing device by the hand of an operator.
- 19) The liquid dispensing device as in Claim 13, wherein said syringe means is automatically removably inserted into said liquid dispensing device by the utilization of an automated liquid mixing means, and wherein liquid is automatically transferred to a liquid receiving means.
- 20) The liquid dispensing device as in Claim 19, wherein said liquid receiving means is a micro-well plate.
- 21) The liquid dispensing device as in Claim 19, wherein said liquid dispensing device is at least one liquid dispensing device, wherein said automated liquid handling means comprises:
  - A. a robotic syringe grabber means positionable above said at least one liquid dispensing device,
  - B. at least one horizontal positioning linear actuator means for horizontally positioning said robotic syringe grabber means above said at least one liquid dispensing device, and
  - C. a computer means programmed to control said at least one horizontal positioning linear actuator means and said robotic syringe grabber means.

22) The liquid dispensing device as in Claim 21, wherein said syringe comprises a plunger means, wherein said robotic syringe grabber means comprises:

- A. a linear actuator means for vertically positioning said robotic syringe grabber means at the height of said syringe means and for lifting said syringe means clear of said at least one liquid dispensing device, and for positioning said robotic syringe grabber means at the height of said liquid receiving means,
- B. a syringe gripper means for gripping said syringe means,
- C. a plunger gripper means for gripping said plunger means, and
- D. a second linear actuator means for raising said plunger means to draw liquid into said syringe means and for lowering said plunger means to dispense liquid into said liquid receiving means.

23) The liquid dispensing device as in Claim 22, wherein said robotic syringe grabber means further comprises an actuator means for transmitting shock waves to said syringe means, wherein said shock waves are utilized to dislodge drops of liquid adhering to said syringe means.

24) The liquid dispensing device as in Claim 19, wherein said liquid dispensing device is a plurality of liquid dispensing devices arranged on a platform means, wherein each of said plurality of liquid dispensing devices comprises at least one locating indentation means, wherein said platform means comprises at least one locating pin means, wherein said at least one indentation means is aligned with said at least one locating pin means.

25) A method for dispensing liquid, comprising the steps of:

- A. inserting a syringe into a liquid dispensing device, wherein said liquid dispensing device comprises:

1. a tray for holding a liquid at a relatively constant level defining an approximately constant tray liquid level, and
2. a liquid container containing a liquid having an opening and positioned upside-down in said tray with the opening defining a vertical position approximately equal to or below the relatively constant tray liquid level such that atmospheric pressure on the liquid in said tray and vacuum inside said container prevents liquid from draining from said container except when the liquid level is said tray drops to a level approximately equal to or below to the vertical position of said opening,

wherein positioning of said syringe for drawing fluid is simplified by reason of the fact that the level of fluid in said tray is maintained at an approximately constant level despite withdrawal of quantities of fluid from said tray.

- B. drawing liquid into said syringe,
- C. removing said syringe from said liquid dispensing device, and
- D. dispensing liquid from said syringe into a liquid receiving device.

26) The method as in Claim 25, wherein said liquid dispensing device further comprises a retaining clip for attaching said liquid container to said liquid dispensing device.

27) The method as in Claim 25, wherein said liquid dispensing device further comprises an air filter for filtering air entering said liquid dispensing device.

28) The method as in Claim 25, wherein said liquid dispensing device further comprises a tilted bottom component for puddling liquid below said syringe tip.

29) The method as in Claim 25, wherein said liquid dispensing device further comprises a liquid level indicator.

- 30) The method as in Claim 25, wherein said syringe is manually removably inserted into said liquid dispensing device by the hand of an operator.
- 31) The method as in Claim 25, wherein said syringe is automatically removably inserted into said liquid dispensing device by the utilization of an automated liquid mixing device, and wherein liquid is automatically transferred to said liquid receiving device.
- 32) The method as in Claim 31, wherein said liquid receiving device is a micro-well plate.
- 33) The method as in Claim 31, wherein said liquid dispensing device is at least one liquid dispensing device, wherein said automated liquid handling device comprises:
- A. a robotic syringe grabber positionable above said at least one liquid dispensing device,
  - B. at least one horizontal positioning linear actuator for horizontally positioning said robotic syringe grabber above said at least one liquid dispensing device, and
  - C. a computer programmed to control said at least one horizontal positioning linear actuator and said robotic syringe grabber.
- 34) The method as in Claim 33, wherein said syringe comprises a plunger, wherein said robotic syringe grabber comprises:
- A. a linear actuator for vertically positioning said robotic syringe grabber at the height of said syringe and for lifting said syringe clear of said at least one dispensing device, and for positioning said robotic syringe grabber at the height of said liquid receiving device
  - B. a syringe gripper for gripping said syringe,
  - C. a plunger gripper for gripping said plunger, and

- D. a second linear actuator for raising said plunger to draw liquid into said syringe and for lowering said plunger to dispense liquid into said liquid receiving device.

35) The method as in Claim 34, wherein said robotic syringe grabber further comprises an actuator for transmitting shock waves to said syringe, wherein said shock waves are utilized to dislodge drops of liquid adhering to said syringe.

36) The method as in Claim 31, wherein said liquid dispensing device is a plurality of liquid dispensing devices arranged on a platform, wherein each of said plurality of liquid dispensing devices comprises at least one locating indentation, wherein said platform comprises at least one locating pin, wherein said at least one indentation is aligned with said at least one locating pin.

37) A liquid dispensing device, comprising:

- A. a tray for holding a liquid,
- B. a liquid container containing a liquid having an opening and positioned upside-down in said tray with the opening defining a vertical position such that liquid from said container maintains a liquid level in said tray at an approximately constant liquid level that is sufficient to maintain a vacuum in said container such that atmospheric pressure on the liquid in said tray and the vacuum inside said container prevents liquid from draining from said container except when the liquid level in said tray drops to a level in relation to the vertical position of said opening sufficient to permit a small quantity of liquid to drain from said container and to permit a small quantity of air to enter said container slightly reducing said vacuum, and
- C. a syringe for drawing fluid from said tray,

wherein positioning of said syringe for drawing fluid is simplified by reason of the fact that the level of liquid in said tray is maintained at an



approximately constant level despite withdrawal of quantities of liquid from said tray.

- 38) The liquid dispensing device as in Claim 37, further comprising a retaining clip for attaching said upside-down container to said liquid dispensing device.
- 39) The liquid dispensing device as in Claim 37, further comprising an air filter for filtering air entering said liquid dispensing device.
- 40) The liquid dispensing device as in Claim 37, further comprising a tilted bottom component for puddling liquid below said syringe.
- 41) The liquid dispensing device as in Claim 37, further comprising a liquid level indicator.
- 42) The liquid dispensing device as in Claim 37, wherein said syringe is manually removably inserted into said liquid dispensing device by the hand of an operator.
- 43) The liquid dispensing device as in Claim 37, wherein said syringe is automatically removably inserted into said liquid dispensing device by the utilization of an automated liquid mixing device, and wherein liquid is automatically transferred to a liquid receiving device.
- 44) The liquid dispensing device as in Claim 43, wherein said liquid receiving device is a micro-well plate.
- 45) The liquid dispensing device as in Claim 43, wherein said liquid dispensing device is at least one liquid dispensing device, wherein said automated liquid handling device comprises:
  - A. a robotic syringe grabber positionable above said at least one liquid dispensing device,

- B. at least one horizontal positioning linear actuator for horizontally positioning said robotic syringe grabber above said at least one liquid dispensing device, and
- C. a computer programmed to control said at least one horizontal positioning linear actuator and said robotic syringe grabber.

46) The liquid dispensing device as in Claim 45, wherein said syringe comprises a plunger, wherein said robotic syringe grabber comprises:

- A. a linear actuator for vertically positioning said robotic syringe grabber at the height of said syringe and for lifting said syringe clear of said at least one dispensing device, and for positioning said robotic syringe grabber at the height of said liquid receiving device
- B. a syringe gripper for gripping said syringe,
- C. a plunger gripper for gripping said plunger, and
- D. a second linear actuator for raising said plunger to draw liquid into said syringe and for lowering said plunger to dispense liquid into said liquid receiving device.

47) The liquid dispensing device as in Claim 46, wherein said robotic syringe grabber further comprises an actuator for transmitting shock waves to said syringe, wherein said shock waves are utilized to dislodge drops of liquid adhering to said syringe.

48) The liquid dispensing device as in Claim 43, wherein said liquid dispensing device is a plurality of liquid dispensing devices arranged on a platform, wherein each of said plurality of liquid dispensing devices comprises at least one locating indentation, wherein said platform comprises at least one locating pin, wherein said at least one indentation is aligned with said at least one locating pin.